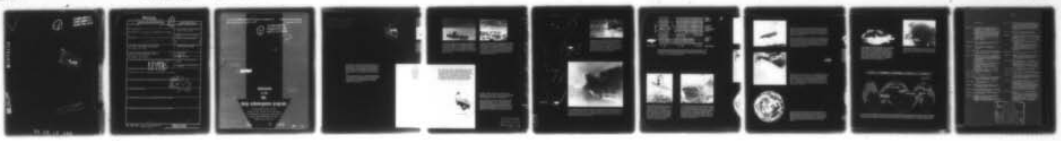
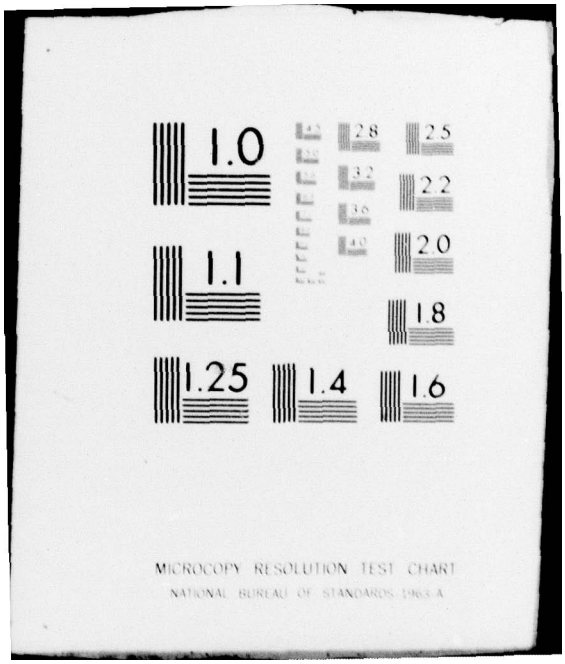
AD-A074 138 NAVY ELECTRONICS LAB SAN DIEGO CA F/G 13/10.1
MILESTONES IN THE NEL DEEP SUBMERGENCE PROGRAM.(U)
JAN 65
UNCLASSIFIED NEL-1255 NL

| OF |
AD A074138




1.0
1.1
1.25
1.4
1.6
2.8
3.2
3.6
4.0
2.5
2.2
2.0
1.8
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER	2. GOVT ACCESSION NO. (1) / 3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) (6) MILESTONES IN THE NEL DEEP SUBMERGENCE PROGRAM.	5. TYPE OF REPORT & PERIOD COVERED: Special prog. rpt.
	6. PERFORMING ORG. REPORT NUMBER: #1255
7. AUTHOR(s) (14) NEL-1255	8. CONTRACT OR GRANT NUMBER(s) (9) Special progress rept.
9. PERFORMING ORGANIZATION NAME AND ADDRESS: U.S. Navy Electronics Laboratory, San Diego, CA 92152	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS (12) 9p.
11. CONTROLLING OFFICE NAME AND ADDRESS: Office of Naval Research, Code 220, 800 North Quincy Street, Arlington, VA 22217 (11)	12. REPORT DATE: 11 JAN 65
	13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS. (of this report): UNCLAS
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

LEVEL II

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

253 550 JAB

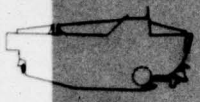
DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE
S/N 0102-LF-014-6601

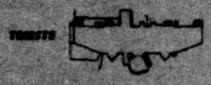
UNCLASSIFIED

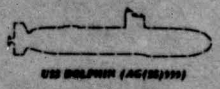
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

U. S. NAVY ELECTRONICS LABORATORY, SAN DIEGO, CALIFORNIA 92152 • A BUREAU OF SHIPS LABORATORY

special progress report 1255 *11 january 1965*



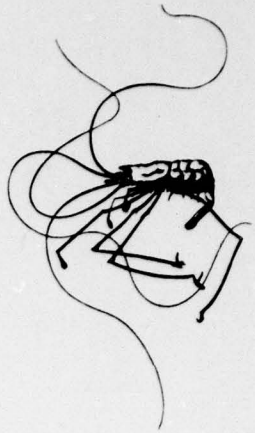




milestones in the NEL deep submergence program

A pictorial history of the major *in situ* marine environmental investigations carried out aboard the bathyscaph TRIESTE and other underwater vehicles.

ON THE COVER: A pioneer in deep-sea operations, the U.S. Navy Electronics Laboratory is contributing its know-how to the development of new second-generation, deep submersibles such as ALVIN by furnishing reliable communication, navigation, and environmental sensing systems. NEL has also been designated as the lead laboratory for the research phase of the proposed research submarine USS DOLPHIN (AG(SS) 555).

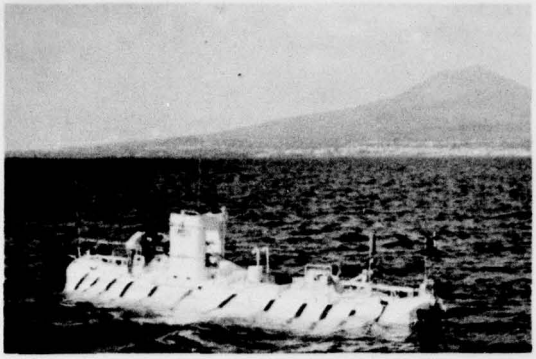


The Tyrrh
evaluatio
summer
environm
research
gram usi
personn

PREFACE This report summarizes the scientific efforts of the Deep Submergence Program at the Navy Electronics Laboratory, San Diego, California. Since its inception in 1958, the program has been vitally concerned with development of techniques, instrumentation, and vehicles to fulfill its assignment - research of the marine environment, from the continental shelf to the abyssal sea floor.

While NEL's primary interests are in relating applied research data in marine acoustics, biology, geology, and physical oceanography to antisubmarine and submarine warfare projects, the Deep Submergence Program has also added significantly to man's basic knowledge of the ocean sciences.

After TRIESTE
dives and
where depths
bottom wate
but the wate
underwate
in preparat
and the



The Tyrrhenian Sea off Naples, Italy, was the site for bathyscaph evaluation dives funded by the Office of Naval Research during the summer of 1957. Objectives: *in situ* studies of the deep ocean environment and appraisal of TRIESTE's capabilities as a deep-diving research vehicle. The tests proved successful, and a research program using TRIESTE was recommended by the scientists and military personnel involved.

TRIESTE was purchased by the Office of Naval Research and assigned to the Navy Electronics Laboratory in September 1958. The vessel is berthed and serviced at NEL's waterfront area, shown here. NEL was selected because of the Laboratory's program and achievements in many types of underwater studies; the presence of nearby deep-water diving sites; the year-round favorable weather and sea conditions; the excellent support facilities; and the proximity of other oceanographic research centers.

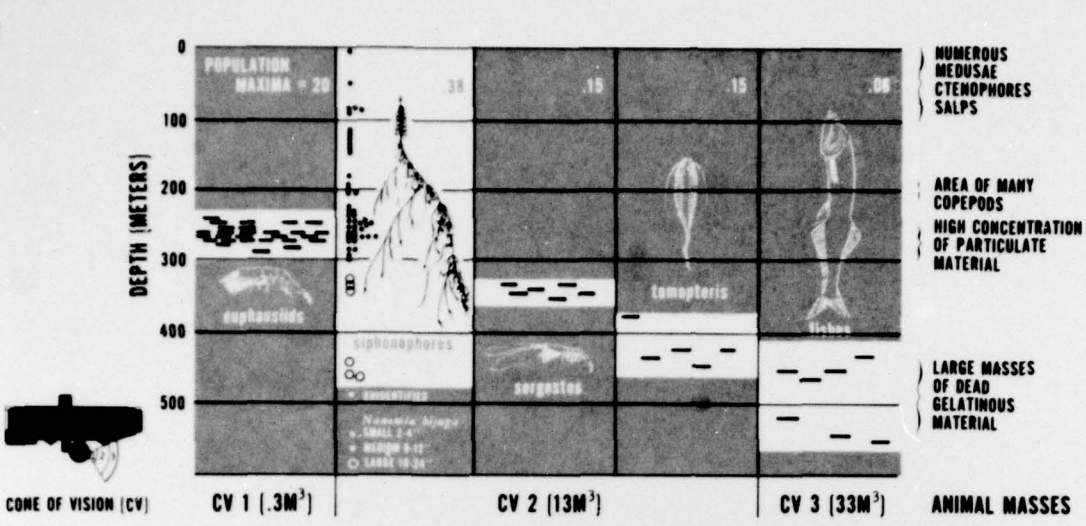
After TRIESTE's arrival at NEL, a carefully planned series of scientific dives and tests began in the Loma Sea Valley and San Diego Trough, where depths of 4100 feet were reached. New data were obtained on bottom water currents, marine organisms, bioluminescence throughout the water column, and topographic features of the sea floor. Underwater-sound experiments were also successfully conducted. In preparation for Project Nekton, TRIESTE's float was lengthened and the observation sphere and instrumentation were improved.

The deepest underwater observations ever made by man were achieved during Project Nekton from November 1959 to January 1960. Equipped with a stronger, specially constructed observation sphere, TRIESTE made preliminary dives to 22,540 feet off Guam.

Climax of the Nekton series was the record dive in the Challenger Deep, 200 miles southwest of Guam. TRIESTE descended 35,800 (±500) feet to the deepest known point in the oceans to find a uniformly flat sea floor composed of white, extremely fine material. A flat fish sighted on the bottom provided dramatic proof that the abyssal depths could support higher forms of life. For their historic achievement, the major participants received presidential citations.

Project Nekton II in the Guam area (June-July 1960) saw TRIESTE outfitted with a Nansen water bottle rack attached to her stern for experiments relating sound speed to temperature and salinity throughout the water column. Also aboard were delicate instruments for measuring gravity (a bottom gravity value -g of 978.9331 cm/sec² was found at a depth of 7498 feet). Thus the bathyscaph demonstrated her worth as a versatile and stable platform from which very precise measurements could be taken.

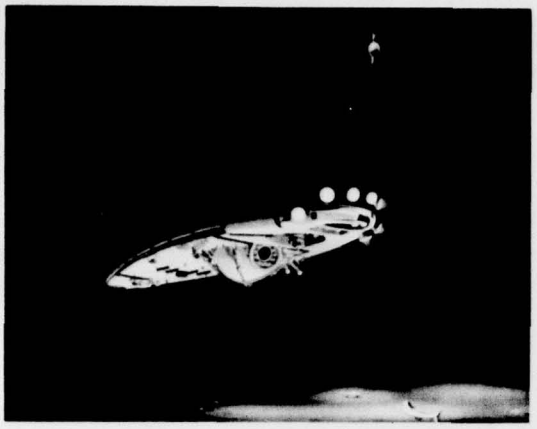
A series of bathyscaph dives in the San Diego area in 1962 resulted in sufficient new data for nineteen formal reports on BUSHIPS-assigned problems. In acoustics, for example, the first *in situ* measurements of sound velocity and attenuation were made in bottom sediments deeper than 100 feet. Sound velocity and attenuation probes attached to TRIESTE (right), pierced the sea floor and measured sound travel time over a 1-meter path, 46 centimeters below the water-sediment interface.



Biological studies during 1962 revealed concentrations of marine animals in distinct layers. Chart shows depth and daytime vertical distribution of dominant organisms as observed from TRIESTE in dive 103, 20 July. Rate of descent was relatively constant. Pigmentation and size of animals played an important role in determining population density.

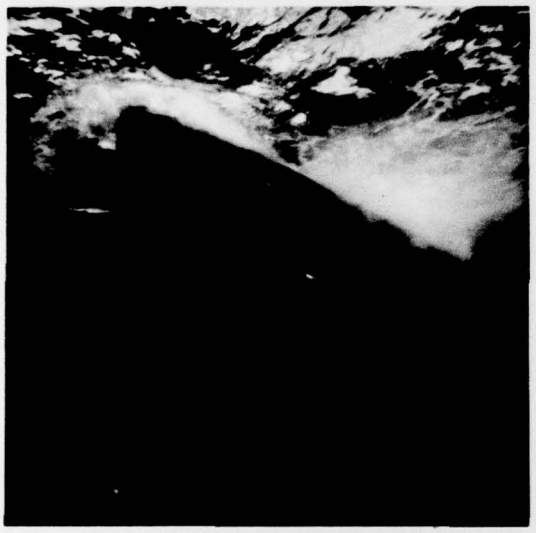
Sea floor topographic investigations by TRIESTE, in the 1962 series, revealed extremely steep slopes off San Diego, unchartable by echo sounder, and established the occurrence of submarine erosional features and processes. Other bottom studies determined the distribution and stability of sediment types. Pulsating deep-sea currents were observed and recorded for the first time. Simultaneously, transducers and other environmental sensing instruments were tested at various depths.

The bathyscaph's unique ability to survey the deep-sea floor led to her use in the search for the nuclear attack submarine THRESHER, lost in the Atlantic Ocean off Boston on 10 April 1963. Techniques developed for replenishment-at-sea helped TRIESTE maintain round-the-clock operations. Wreckage later identified as belonging to THRESHER was found and photographed in 8200 feet of water. The bathyscaph's mechanical arm retrieved copper piping and a fitting. TRIESTE was the only vessel in the nation capable of operating at the depth the wreckage was found.



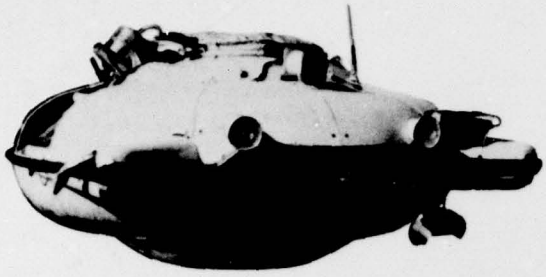
Late in 1963, TRIESTE's operational characteristics were greatly improved by addition of a completely redesigned float, constructed at Mare Island Naval Shipyard. The new float features recessed shot tubs and observation sphere. Other changes increase bottom time and payload by one-third, and permit operations in much higher sea states. The new craft was dedicated TRIESTE II, at NEL on 17 January 1964.

A series of eleven test and scientific dives off San Diego occupied the period February to March 1964. New acoustical, biological, and geological data were obtained. After the last dive, the bathyscaph "shipped out" for the Atlantic where she made a detailed visual and photographic survey of the THRESHER debris area. Search and inspection techniques developed in this series will be of great assistance to the Navy in improving the operations of manned, deep-search vehicles of the future.



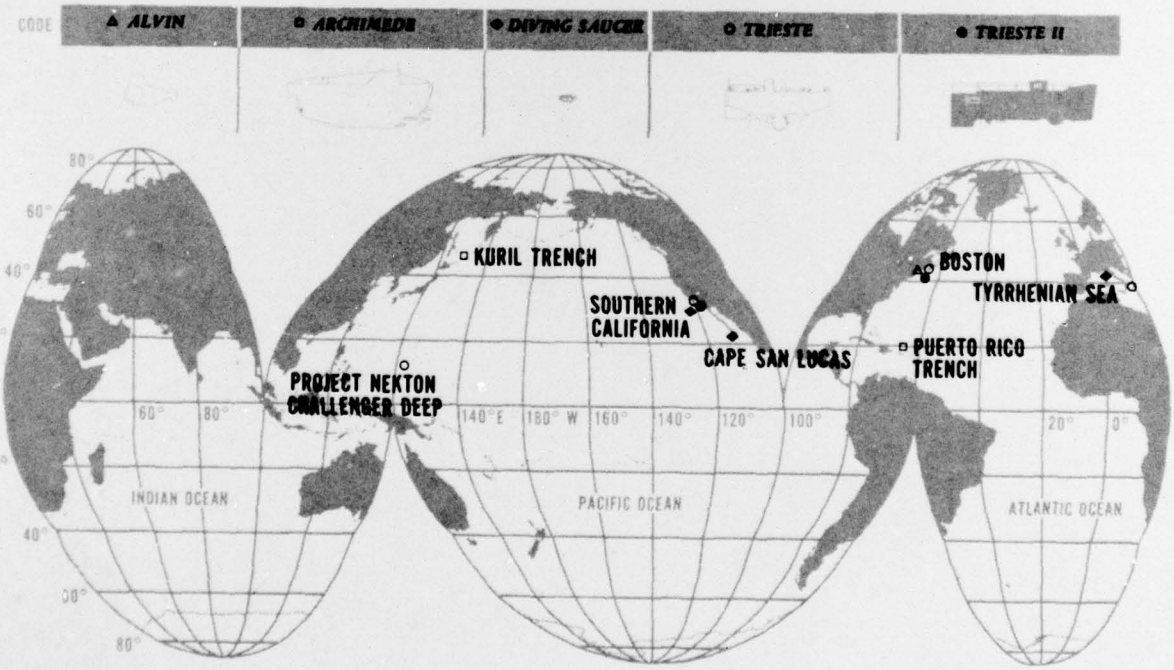
While TRIESTE II was on the East Coast, NEL scientists participated in an ONR-sponsored probe of the Puerto Rican Trench. Lamont Geological Observatory, Hudson Laboratories, NEL, and French scientists, carried out biological and geological studies aboard the French Navy bathyscaph ARCHIMEDE, shown above. Deep-sea operation of sonar and navigation systems were also investigated. Gravity measurements and rock samples taken may help explain the origin of the elongated trench which reaches the greatest known depth in the Atlantic Ocean -- 30, 180 feet.

Early in 1965, TRIESTE II extended the study of the continental shelf off Southern California to sea-floor depths as great as 13, 000 feet. From the bathyscaph's observation sphere, determination of factors affecting sound speed and reverberation throughout the water column, measurement of the acoustic and physical properties of the ocean floor, and other research is being carried out in support of antisubmarine and submarine warfare programs.



Intermediate depths to 1000 feet are also being intensively examined by NEL geologists, biologists, oceanographers, and acousticians, with this leased, highly maneuverable, jet Diving Saucer. A 6-month study of the continental shelf began in November 1964, in cooperation with Scripps Institution of Oceanography, Naval Ordnance Test Station, Naval Missile Center, Pacific Missile Range, and the Navy Underwater Sound Laboratory. The investigations ranged northward to Point Mugu, California, and southward to Nayarit, Mexico, east of the tip of Baja California.

A segment in the sea's food chain is viewed from the Diving Saucer in La Jolla Canyon. After spawning, squids die and are consumed by bottom organisms. Here, a flat fish (center, left) feeds on a dead squid.



The future NEL Deep Submergence Program will continue to reflect the immediate and long-term needs of the Navy for detailed, accurate knowledge of the marine environment. To provide this information NEL combines competent scientific guidance and methods with the latest advancements in underseas technology. World map shows areas in which NEL scientists and technical personnel have participated in deep *in situ* marine environmental studies.

BIBLIOGRAPHY

Barham, E. G., "Characteristics of Some Spurious Midwater Acoustic Targets," in Proceedings of the 1st Navy Military Oceanographic Symposium, Washington, D. C., 17-19 June 1964. (In press)

"The Deep Scattering Layer Off the California Coast (Abstract)," p. 18 in Office of Naval Research Symposium Report ACR-84, Navywide Workshop in Biological Sciences Research, 14-18 October 1963.

"The Deep Scattering Layer as Observed From the Bathyscaph TRIESTE (Abstract)," p. 298-300 in International Congress of Zoology, Proceedings, 16th, v. 4, 20-27 August 1963, XVI International Congress of Zoology, 1963.

"Siphonophores and the Deep Scattering Layer," Science, v. 140, p. 826-828, 17 May 1963

Batzler, W. E. and Barham, E. G., "Acoustic Scattering From a Layer of Siphonophores (Abstract)," Acoustical Society of America, Journal, v. 35, p. 792-793, May 1963

Buffington, E. C., "Structural Control and Precision Bathymetry of La Jolla Submarine Canyon, California," Marine Geology, v. 1, p. 44-58, February 1964

Curl, G. H., Discussion on Paper, "The Promising Aspects of Deep-Sea Vehicles," by M. de C. Vincent and A. B. Stavovy, Society of Naval Architects and Marine Engineers, Transactions, v. 71, p. 244-245, 1963

Dietz, R. S., "Bathyscaphs and Other Deep Submersibles for Oceanographic Research," p. 497-515 in Hill, M. N., The Sea; Ideas and Observations on Progress in the Study of the Seas, v. 2: The Composition of Sea-Water Comparative and Descriptive Oceanography, Interscience Publishers, 1963.

"The Sea's Deep Scattering Layers," Scientific American, v. 207, p. 44-50, August 1962.

"Underwater Research Craft," p. 514-515 in McGraw-Hill Yearbook of Science and Technology, 1962, McGraw-Hill, 1962.

"1100-Meter Dive in the Bathyscaph TRIESTE," Limnology and Oceanography, v. 4, p. 94-101, January 1959.

"Deep-Sea Research in the Bathyscaph TRIESTE," New Scientist, v. 3, April 1958.

"Bathyscaphe TRIESTE," Office of Naval Research, London Branch Technical Report ONRL-71-55, 1955

Dietz, R. S. and others, "The Bathyscaph," Scientific American, v. 198, p. 27-33, April 1958

Dietz, R. S. and Piccard, J., Seven Miles Down, Putnam, 1961

Dill, R. F. and Shumaker, L. A., "Geological Features of La Jolla Canyon as Revealed by Dive No. 83 of the Bathyscaph TRIESTE," Navy Electronics Laboratory Technical Memorandum 516, 27 December 1961

Dill, R. F. and others, "Submarine Geology by Diving Saucer," Science, v. 145, p. 1042-1046, 4 September 1964

Hamilton, E. L., "Sediment Sound Velocity Measurements Made *in situ* From the Bathyscaph *TRIESTE*," Journal of Geophysical Research, v. 68, p. 5991-5998, November 1963

Jarlov, N. G. and Piccard, J., "Bathyscaph Measurements of Daylight Penetration into the Mediterranean," Deep-Sea Research, v. 5, p. 201-204, 1959

Kasch, D. L., "Down to THRESHER by Bathyscaph," National Geographic Magazine, v. 125, p. 764-777, June 1964

LaFond, E. C., "Bathyscaph Dive Eighty-Four (Abstract)," Journal of Geophysical Research, v. 67, p. 3573, August 1962.

"Dive Eighty-Four," Sea Frontiers, v. 8, p. 94-102, May 1962.

"Deep Current Measurements with the Bathyscaph TRIESTE," Deep-Sea Research, v. 9, p. 115-116, March/April 1962

Lewis, R. V., "Preliminary Report of the U. S. Navy Underwater Sound Laboratory Portion of the Experimental Program Conducted Aboard Bathyscaph TRIESTE June Through October 1957," Navy Underwater Sound Laboratory Technical Memorandum 1210-140-57, 9 December 1957.

"Deep Water Communication Aboard the Bathyscaph TRIESTE," Navy Underwater Sound Laboratory Technical Memorandum 1210-103-57, 26 August 1957

Logan, R. K., "Evaluation of the Control Characteristics of Bathyscaph Ballast," Navy Electronics Laboratory Report 956, 11 February 1960

Mackenzie, K. V., "Bathyscaph TRIESTE Operations in the THRESHER Search," U. S. Navy Journal of Underwater Acoustics, v. 14, p. 301-309, CONFIDENTIAL, April 1964.

"Bathyscaph Aids Sound-Speed Measurements," Bureau of Ships Journal, v. 12, p. 33-35, May 1962.

"Further Remarks on Sound-Speed Measurements Aboard the TRIESTE," Acoustical Society of America, Journal, v. 34, p. 1148-1149, August 1962.

" Sound-Speed Measurements Aboard the French Bathyscaph ARCHIMEDE at Japan (Abstract)," Acoustical Society of America, Journal, v. 34, p. 1974, December 1962.

"Sound-Speed Measurements Utilizing the Bathyscaph TRIESTE," Acoustical Society of America, Journal, v. 33, p. 1113-1119, August 1961

Martin, G. W., "TRIESTE - The First Ten Years," U. S. Naval Institute, Proceedings, v. 90, p. 52-64, August 1964

Maxwell, A. E., "The Bathyscaph - A Deep-Water Oceanographic Vessel, Pt. 1: A Report on the 1957 Scientific Investigations with the Bathyscaph TRIESTE," U. S. Navy Journal of Underwater Acoustics, v. 8, p. 149-154, April 1958

Moore, D. G., "Observations of an Erosional Channel Wall in La Jolla Sea-Fan Valley From Bathyscaph TRIESTE II," Geological Society of America Bulletin. (In press)

"Geological Observations From the Bathyscaph TRIESTE Near the Edge of the Continental Shelf Off San Diego, California," Geological Society of America, Bulletin, v. 74, p. 1057-1062, August 1963

Piccard, J. and Dietz, R. S., "Oceanographic Observations by the Bathyscaph TRIESTE (1953-1956)," Deep-Sea Research, v. 4, p. 221-229, 1957

Pickwell, G. V., Barham, E. G. and Wilton, J. W., "Carbon Monoxide Production by a Bathypelagic Siphonophore," Science, v. 144, p. 860-862, 15 May 1964

Rechnitzer, A. B., "Summary of the Bathyscaph TRIESTE Research Program Results (1959-1960)," Navy Electronics Laboratory Report 1095, 2 April 1962.

"The 1957 Diving Program of the Bathyscaph TRIESTE," Navy Electronics Laboratory Report 941, 28 December 1959

Shumaker, L. A., "TRIESTE II," Naval Engineers Journal, v. 76, p. 513-519, August 1964.

"Exploring Hydrospace - The Earth's Last Great Frontier," Arizona Engineer & Scientist, v. 5, p. 8-10, November 1961.

"Deep Submergence Propulsion Motors for Bathyscaph TRIESTE," Navy Electronics Laboratory Technical Memorandum 519, 8 January 1962.

"Evaluation of External Lighting Systems for the Bathyscaph TRIESTE," Navy Electronics Laboratory Report 1094, 21 December 1961.

"Evaluation of External Battery Power Supply for Bathyscaph TRIESTE," Navy Electronics Laboratory Report 1063, 18 August 1961

Walsh, D., "The Bathyscaph as an Acoustic Vehicle," Naval Research Reviews, p. 14-18, April 1962.

"The Bathyscaph TRIESTE - Technological and Operational Aspects, 1958-1961," Navy Electronics Laboratory Report 1096, 27 July 1962.

"The Future Use of Deep Submersible Vehicles," Houston Geological Society, Bulletin, v. 4, p. 12-17, November 1961.

"New Eyes for the Scientist," Frontiers, v. 25, p. 3-7, October 1961.

"The Bathyscaph as an Acoustic Vehicle," U. S. Navy Journal of Underwater Acoustics, v. 11, p. 749-752, October 1961